

Amendments to the Specification:

Please insert the following text after the Title on page 1:

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a national part of International Application PCT/EP2004/007456 having an international filing date of July 8, 2004 and claiming priority of German Patent Application DE 103 33 644.3, filed July 24, 2003. The full disclosures of both earlier Applications are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

Please replace the paragraph on page 1, beginning on line 5 and ending on line 17, with the following paragraph:

The invention relates to a projection exposure apparatus for microlithography, ~~having an illumination device for generating projection light, a projection objective with a plurality of optical elements, by which a reticle that can be arranged in an object plane of the projection objective can be imaged onto a photosensitive surface, which can be arranged in an image plane of the projection objective and is applied on a support, and having an immersion device for introducing an immersion liquid into an immersion space between a last optical element on the image side of the projection objective and the photosensitive surface. The invention also relates and to a method for introducing an immersion liquid into such an immersion space.~~

Please insert the following sub header on page 1 after line 17:

2. Description of the Related Art

Please replace the paragraph on page 1, beginning on line 18 and ending on page 2, line 7, with the following paragraph:

~~A projection exposure apparatus and a method of this type are known from EP 0 023 243 A1.~~ In order to hold a semiconductor wafer to be exposed, ~~a~~ this known projection exposure apparatus disclosed in EP 0 023 243 A1 has an open-topped container whose upper edge is higher than the lower delimiting surface of the last lens on the image side of the projection objective. Feed and discharge lines for an immersion liquid open into the container, and these are connected to a pump, a temperature regulating device and a filter for cleaning the immersion liquid.

When the projection exposure apparatus is in operation, the immersion liquid is circulated in a liquid circuit while an intermediate space, which is left between the lower delimiting surface of the last lens on the image side of the projection objective and the semiconductor wafer to be exposed, remains filled. The resolving power of the projection objective is intended to be increased because of the higher refractive index of the immersion liquid, which in this known projection exposure apparatus preferably corresponds to the refractive index of the photosensitive layer applied on the semiconductor wafer.

Please insert the following header at page 2 after line 25:

SUMMARY OF THE INVENTION

Please replace the paragraph on page 2, beginning on line 26 and ending on line 29, with the following paragraph:

It is therefore an object of the invention to provide a projection exposure ~~apparatus objective of the type mentioned in the introduction~~, which makes it possible to ~~with which it is possible to~~ achieve a higher imaging quality.

Please replace the paragraph on page 2, beginning on line 30 and ending on page 3, line 2, with the following paragraph:

This object is achieved by a projection exposure apparatus with an immersion device that ~~in that the immersion device comprises means by which the creation of gas bubbles in the immersion liquid can be prevented and/or gas bubbles which have already been created can be removed.~~

Please replace the paragraph on page 4, beginning on line 5 and ending on line 14, with the following paragraph:

The immersion device according to the invention may, for example, comprise a suction device for extracting gas bubbles, which has a suction ~~gland-nozzle~~ opening into the immersion space. This suction ~~gland-nozzle~~, which can be provided in addition to a suction ~~gland-nozzle~~ that may furthermore be required in order to circulate the immersion liquid, preferably extracts immersion liquid, with bubbles contained in it, in the immediate vicinity of the last optical element on the image side, so that these bubbles cannot impair the imaging quality.

Please replace the paragraph on page 5, beginning on line 11 and ending on line 20, with the following paragraph:

It is furthermore preferable for the immersion device to have circulation means for circulating the immersion liquid in the immersion space, which comprise a circulating pump, a filling ~~gland nozzle~~ opening into the immersion space and a suction ~~gland-nozzle~~ opening into the immersion space. By means of this, in circulating operation, it is possible for the immersion liquid to be constantly cleaned, thermally regulated and also degassed, if a degasser for removing gas bubbles from the immersion liquid is additionally provided.

Please replace the paragraph on page 6, beginning on line 15 and ending on line 19, with the following paragraph:

In this context, it is naturally preferable for the suction gland-nozzle of the circulation means to be arranged before the filling gland-nozzle of the circulation means in the scanning direction, since in this way extraction of the immersion liquid is assisted by the scanning movement.

Please insert the following header at page 9 after line 11:

BRIEF DESCRIPTION OF THE DRAWINGS

Please insert the following header at page 9 after line 28:

DESCRIPTION OF PREFERRED EMBODIMENT

Please replace the paragraph on page 10, beginning on line 1 and ending on line 9, with the following paragraph:

Figure 1 shows a meridian section through a microlithographic projection exposure apparatus, denoted overall by 10, in a highly simplified schematic representation. The projection exposure apparatus 10 has an illumination devicesystem 12 for generating projection light 13, which comprises inter alia a light source 14, illumination optics indicated by 16 and a diaphragm 18. In the exemplary embodiment represented, the projection light has a wavelength of 157 nm.

Please replace the paragraph on page 12, beginning on line 5 and ending on line 22, with the following paragraph:

The volume lying in the beam path of the projection objective 20 between the lens L5 and the photosensitive surface 26 is filled with immersion liquid 34, and will therefore be referred to below as an immersion space 50. The immersion space 50 is sealed laterally by an open-topped ring 52, and towards the photosensitive surface 26 by a sealing element 54. The sealing element 54 may be obviated if the pressure of the surrounding gas is high enough to prevent the immersion

liquid 34 from emerging. The ring 52 contains a first bore 56, which is connected to the feed line 36 and whose end opening into the immersion space 50 forms a filling gland-nozzle 58. The ring 52 furthermore contains a second bore 60, which is connected to the discharge line 38 and whose end opening into the immersion space forms a suction gland-nozzle 62. The feed line 36 and the discharge line 38 are connected to a circulating pump 64, which can circulate the immersion liquid 34 in a closed circuit.

Please replace the paragraph on page 13, beginning on line 26 and ending on page 14, line 9, with the following paragraph:

Figure 4 shows a part of an immersion device according to another exemplary embodiment, in which the immersion space 50 is framed by side walls only laterally, i.e. parallel to the plane of the paper, but not transversely to a scanning direction indicated by an arrow 84. The scanning direction 84 is the direction in which the support 30 moves under the lens L5 during the scanning operation. This relative motion between the support 30 and the lens L5 creates a transport effect, by which immersion liquid 34 emerging from a filling gland-nozzle 58' opening into the immersion space 50 is delivered to a suction gland-nozzle 62', which likewise protrudes into the immersion space 50. This transport motion prevents immersion liquid 34 escaping from the immersion space 50 counter to the scanning direction 84.

Please replace the paragraph on page 14, beginning on line 23 and ending on line 27, with the following paragraph:

The frame 46' of the lens L5 also includes a suction gland-nozzle 86, the purpose of which is to immediately extract gas bubbles created in the exit region of the filling gland-nozzle 58', before they can reach the image-side delimiting surface of the lens L5 and cause imaging errors there.

Please insert the following paragraph on page 15, after line 21:

The above description of the preferred embodiments has been given by way of example. From the disclosure given, those skilled in the art will not only understand the present invention and its attendant advantages, but will also find apparent various changes and modifications to the structures and methods disclosed. The applicant seeks, therefore, to cover all such changes and modifications as fall within the spirit and scope of the invention, as defined by the appended claims, and equivalents thereof.